

XVIII. *Some Experiments upon the Ochra friabilis nigro fusca of Da Costa, Hist. Foss. p. 102.; and called by the Miners of Derbyshire, Black Wadd. By Josiah Wedgwood, F. R. S.*

Read March 13, 1783.

THE extraordinary circumstance of this substance taking fire upon being slightly mixed with linseed oil, first discovered by accident in the year 1752, at Mr. BASSANO's, a painter in Derby, has rendered it a subject of curiosity; but, as it is now employed in considerable quantities, and very advantageously, as an oil-colour in ship and house-painting, it has a better claim to our attention; and it is hoped, an attempt towards the further investigation of so curious and useful an earth may be acceptable to this illustrious Society.

It is many years since I first collected some of this earth, which bassetted out in a hollow way near Winster, in Derbyshire, and tried some experiments upon it; but as they were not very interesting to me at that time, and my hands being full of other matters, I made no further use of it till December last, when a series of experiments being made at the President's house upon its inflammable property when mixed with oil, at which JOHN WALSH, Esq. and several other gentlemen were present, Mr. WALSH was kind enough to send me a specimen from thence, and express his desire that I would analyse, and make some further experiments upon, this extraordinary substance.

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Mr. WOODWARD, as well as Mr. DA COSTA, has described this earth so minutely, that it cannot easily be mistaken; but from the following experiments it will appear, that it should not be classed amongst the *Ochres not acted upon by acids*; and that it may, with as great propriety, be called *Manganese* as *Ochre*.

EXP. 1. Mixed with porcelain biscuit body, it gives darker or lighter shades of black and brown, as the quantity is greater or less in proportion to the body.

EXP. 2. Mixed with linseed oil, in the quantity of a few penny-weights only, into a paste, it dried very slowly, without producing any perceptible smoke or heat. The quantity, perhaps, was too small for ignition, and, I believe, it was over-dosed with oil.

EXP. 3. When the mineral was previously calcined with a slight red heat about half an hour, the mixture of it with the oil dried much sooner and harder; a circumstance which, if not already known, may render it still more valuable to the painter. In other respects no difference could be observed.

EXP. 4. In the above low heat it suffers no alteration of colour or texture. In a heat of 30° , by my thermometer for measuring high degrees of heat, it loses its property of staining the hands, diminishes very considerably in bulk, acquires a little hardness, though it still proves friable between the fingers, and has its colour changed from a brownish to a blueish black. In a heat of 80° it begins to melt; and at 95° runs into a black scoria.

EXP. 5. With black flux, in a heat of 90° , by the above-mentioned thermometer, it yielded a button of lead, amounting, in one experiment, to 21; and in another to 22 grains from an ounce, or nearly $\frac{1}{2}$.

EXP.

EXP. 6. Water extracts nothing from it. The mineral acids, with the assistance of heat, dissolve about eleven parts out of twelve; but a large quantity of acid is necessary for this solution. The residuum is greyish white, full of bright micaeous particles, with a few fine filaments like those of asbestos, which suffer no change in a moderate red heat. In a heat of 144° , which is 14° beyond the fusion of cast iron, it ran into a perfect glass; but whether this was a vitrification of the pure earth itself, or of a combination of it with the argillaceous matter it was in contact with, the smallness of the quantity did not admit of ascertaining. Upon the Hessian crucible it formed a black glass; what adhered to the thermometer-piece was brown.

EXP. 7. On boiling with oil of vitriol to dryness, the bottom and sides of the mass became red like colcothar, the middle white, the intermediate parts yellow or reddish yellow, and some greenish. These appearances were at first attributed to a vitriol of iron in different degrees of calcination; but, on separating some of the purer white and red parts, the former were found to produce in vitrification the same colour as manganese does, the latter the same as colcothar; the other seemed to be a mixture of the two.

EXP. 8. A solution of the mineral in nitrous acid was precipitated, instead of common alkali, with Prussian lixivium, which has the property of throwing down from acids iron, manganese, and all metallic bodies, but no one of the earthy class. When the addition of this lixivium ceased to make any further precipitation, common alkali, added afterwards, had also no effect; a proof that this mineral contains no earth soluble in acids, for that would have remained in the liquor after
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the precipitation of the other matters by the Prussian lixivium, and been precipitated by the alkali added at last.

EXP. 9. On precipitating a like solution by gradual additions of alkaline lixivium, and separating the precipitates as often as a fresh addition of the alkali occasioned any different appearance from what the preceding had done; the first precipitate was white; the next of a rusty red colour, like precipitate of iron; the last very white, while diffused through the liquor, and when settled, but in drying turned a little brown. The first, which was in a very small quantity, as nearly as could be judged by weighing the filters, about a twentieth part of the other two, was found to be lead; the second was iron; and the third manganese, nearly in equal quantities, all pure, or very nearly so, from one another.

It appears from these experiments, that 22 parts of this mineral contain nearly two of indissoluble earth, chiefly micaceous, 1 of lead, about $9\frac{1}{2}$ of iron, and the same quantity of manganese.

Specimens of the colours produced by vitrification.

Q. The mineral itself.

1. 2. 3. The first, second, and third precipitates.

